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(54) **FUSE ARRAY**

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CPC **G11C 17/16** (2013.01)

(58) **Field of Classification Search**
CPC H01L 23/5256
See application file for complete search history.

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(57) **ABSTRACT**

A fuse array may include: an E-fuse including a plurality of active regions having a floating node and a contact node, and a plurality of gates overlapping the respective active regions and separated from each other between the floating node and the contact node; and a plurality of fuse sets each including two or more E-fuses and sharing the floating node or the contact node.

20 Claims, 4 Drawing Sheets

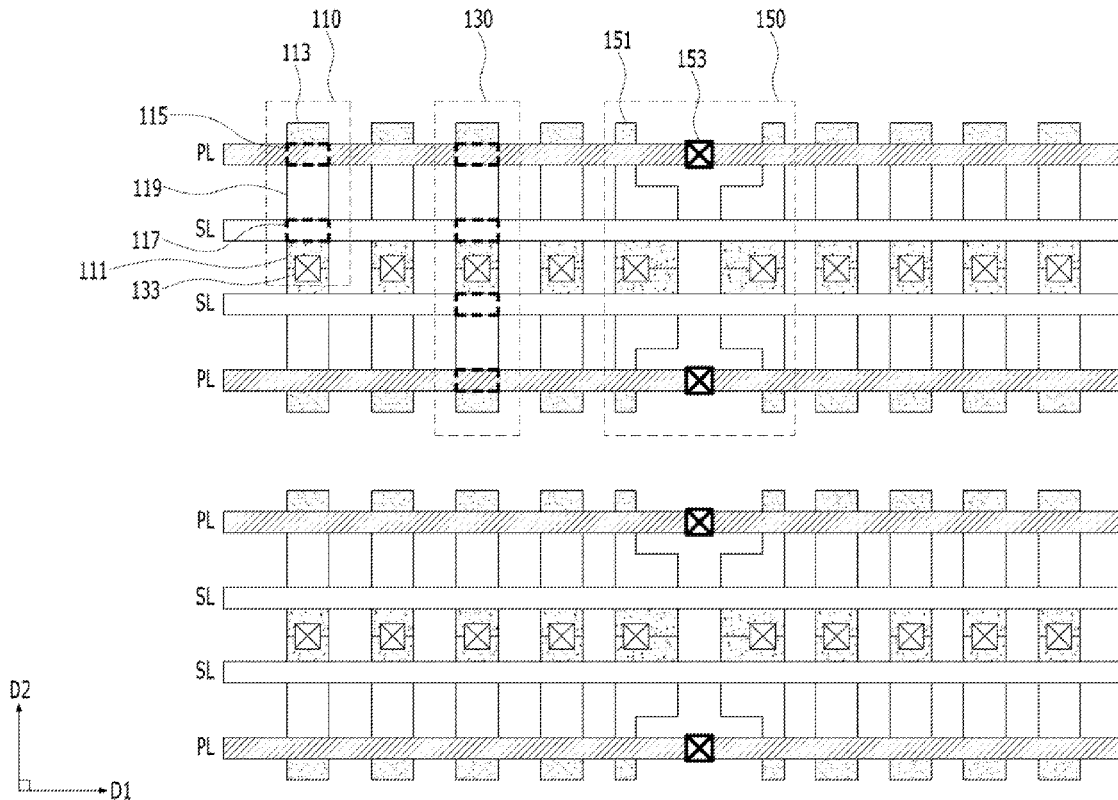


FIG. 1

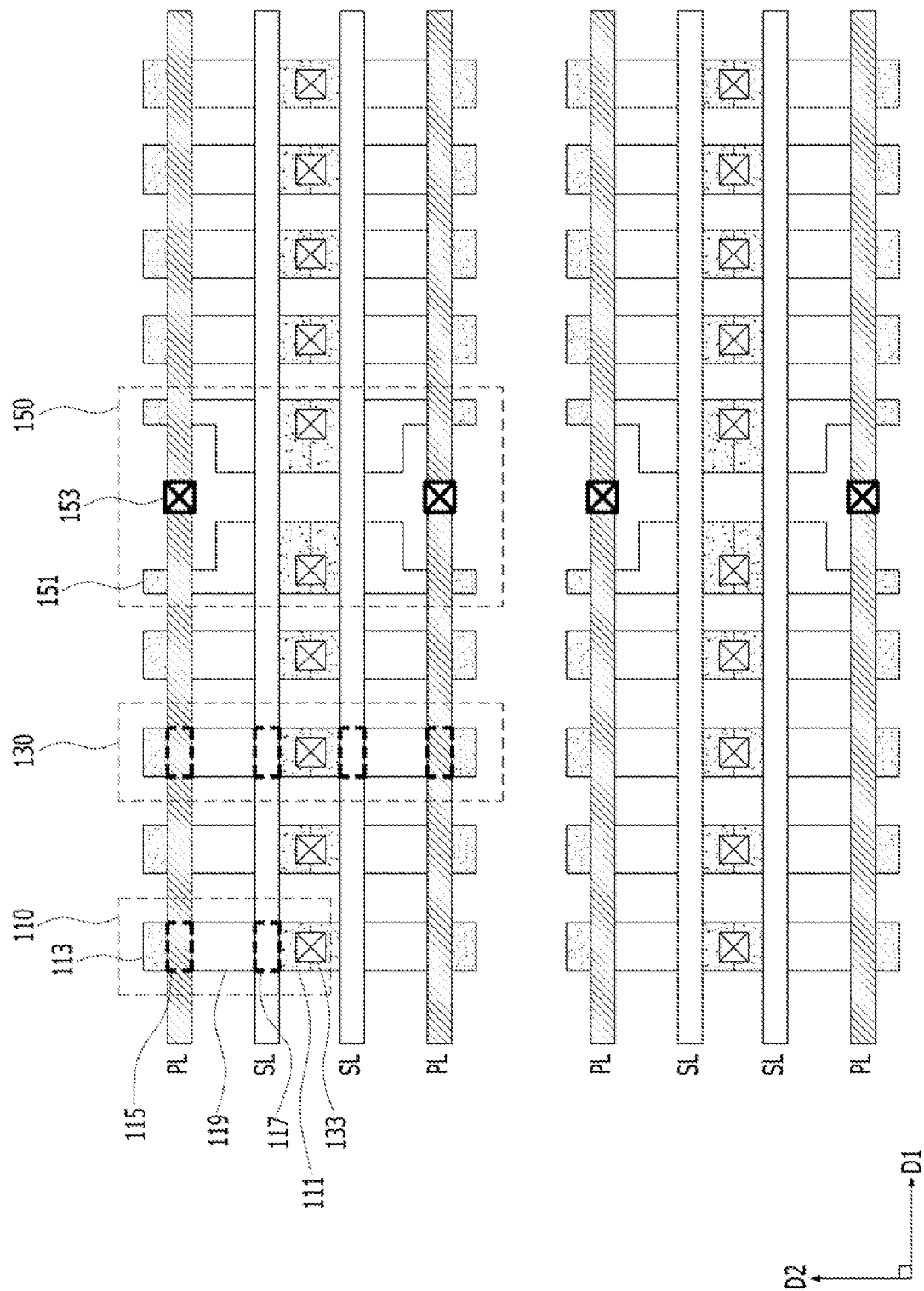


FIG. 2

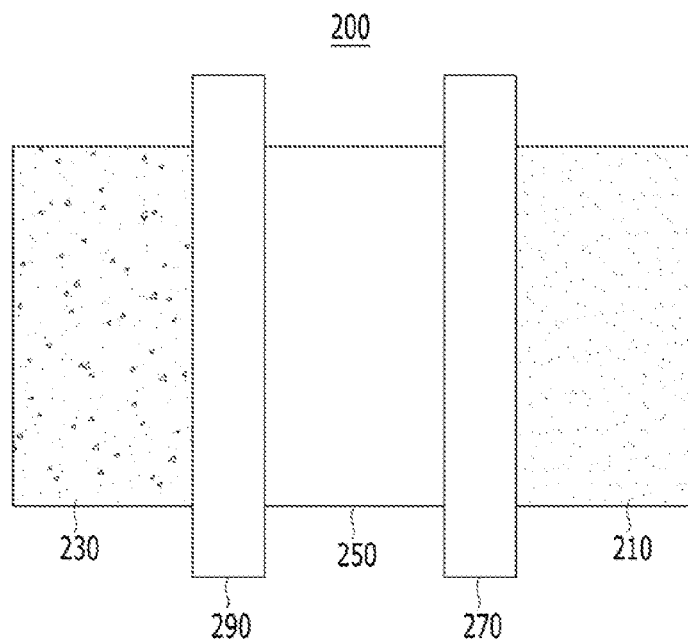


FIG. 3A

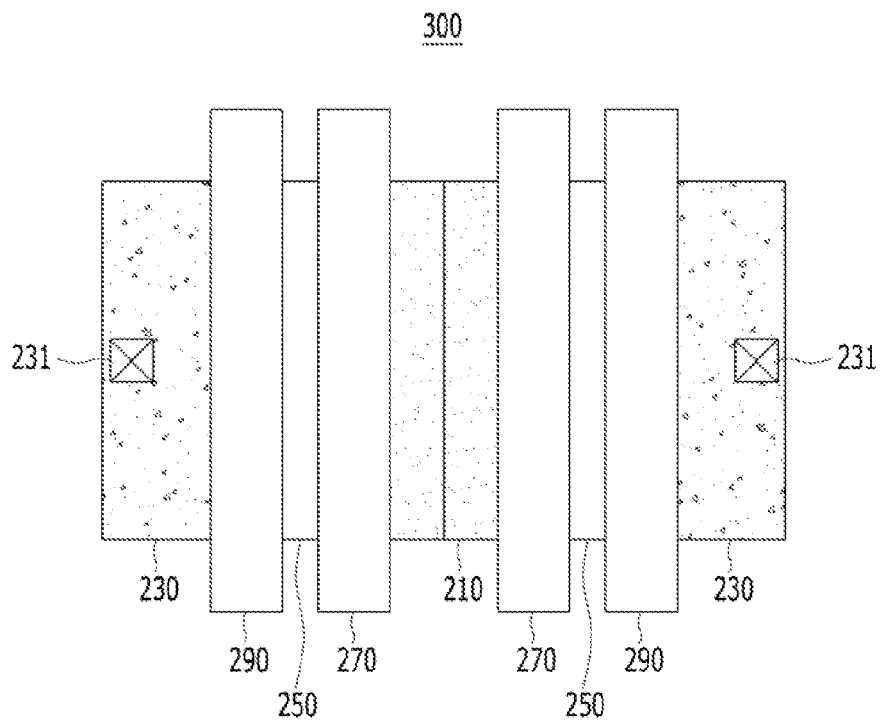
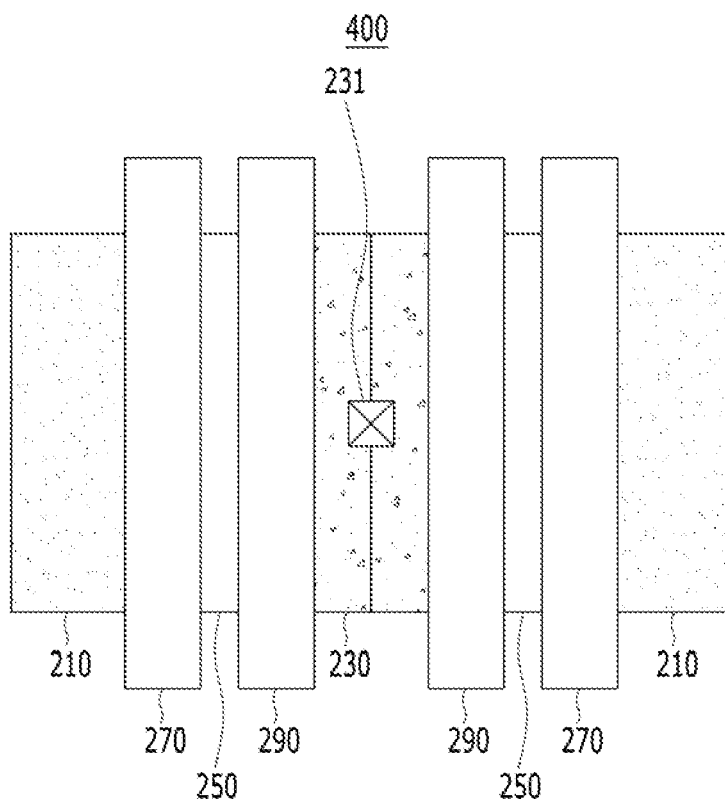


FIG. 3B



FUSE ARRAY

CROSS-REFERENCE TO RELATED APPLICATIONS

The present application claims priority of Korean Patent Application No. 10-2014-0036532, filed on Mar. 28, 2014, which is incorporated herein by reference in its entirety.

BACKGROUND

1. Field

This patent document relates to a semiconductor technology and, more specifically, to a fuse array that includes a plurality of programmable E-fuses.

2. Description of the Related Art

Research is constantly conducted with the goal of increasing the degree of integration and reducing the size of semiconductor devices. E-fuses, which are usually arranged in a two-dimensional array, are a medium in which information may be stored in a semiconductor device. The inventive concept set forth herein is directed at increasing the integration density, reducing the size, and improving the signal transmission characteristics of an E-fuse array.

SUMMARY

Various embodiments are directed to a method for improving the integration degree and signal transmission characteristics of a fuse array including a plurality of programmable E-fuses.

In an embodiment, a fuse array may include a plurality of fuse sets each including two or more E-fuses that share a floating node or a contact node, wherein each E-fuse has an active region where the floating node and the contact node are disposed, and two gates overlapping the active region and separated from each other between the floating node and the contact node.

Another embodiment may include a fuse array which including a plurality of first fuse sets each having two or more E-fuses sharing a floating node and a plurality of second fuse sets each having two or more E-fuses sharing a contact node, wherein the plurality of first fuse sets and the plurality of second fuse sets are arranged in a staggered fashion in a first direction and in a line in a second direction. The E-fuses may have first and second gates overlapping their respective active regions and the gates may be separated from each other between the floating node and the contact node.

In an embodiment, there is provided a fuse array which includes a plurality of active regions each having both ends defined as floating nodes or contact nodes, a plurality of E-fuses having first and second gates overlapping the respective active regions and separated from each other between the floating node and the contact node, a plurality of first fuse sets each having two or more E-fuses sharing the floating node, and a plurality of second fuse sets each having two or more E-fuses sharing the contact node. The plurality of first fuse sets and the plurality of second fuse sets may be arranged in a staggered fashion in a first direction and in a line in a second direction and the fuse array may include: a plurality of first conductive lines extended in the first direction wherein the conductive lines are coupled to the plurality of first gates; a plurality of second conductive lines extended in the first direction and coupled to the plurality of second gates; and a plurality of strapping contact plugs coupled to the first and

second conductive lines between the plurality of first fuse sets and the plurality of second fuse sets in a second direction crossing the first direction.

Another embodiment may include a fuse array which including a substrate having active regions; E-fuses that are formed over the active regions, wherein each of the E-fuse includes a contact node, a floating node, and at least one gate; E-fuse sets that include two or more of the E-fuses, wherein each of the E-fuse sets share either the contact node or the floating node, and the E-fuse sets are positioned in a staggered fashion when viewed from a first direction; conductive lines that extend in the first direction that are connected to the gates of the E-fuses; and strapping contact plugs that are coupled to the conductive lines, wherein the contact plugs are disposed between the E-fuse sets.

The E-fuse sets may include first fuse sets and second fuse sets; the first fuse sets share a floating node and the second fuse sets share a contact node; and the first fuse sets and the second fuse sets are arranged alternately in a second direction, which crosses the first direction. The first fuse sets may include first gates and second gates, the first gates are positioned to face each other around the floating node that is shared, and the second gates are at opposite ends of the first fuse sets to surround the first gates; and the second fuse sets include first gates and second gates, the second gates are positioned to face each other around the contact node that is shared, and the first gates are at opposite ends of the first fuse sets to surround the first gates. The conductive lines include first conductive lines and second conductive lines, the first conductive lines connect first gates from both the first fuse sets and the second fuse sets, and the second conductive lines connect second gates from both the first fuse sets and the second fuse sets. The strapping contact plugs may include a first type strapping contact plugs and second type strapping contact plugs; the first gates are program gates, and the first conductive lines are program lines; the second program gates are select gates and the second conductive lines are select lines; the first type strapping contact plugs are coupled to the first gates of both first fuse sets and the second fuse sets, and are suitable for biasing a program voltage; and the second type strapping contact plugs are coupled to the second gates of both the first fuse sets and the second fuse sets, and are suitable for biasing a select voltage.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a plan view of a fuse array that serves as a comparative example.

FIG. 2 is a plan view of an E-fuse in accordance with an embodiment of the present invention.

FIG. 3A is a plan view of a fuse set including a plurality of E-fuses of which floating nodes are shared.

FIG. 3B is a plan view of a fuse set including a plurality of E-fuses of which contact nodes are shared.

FIG. 4 is a plan view of a fuse array in accordance with an embodiment of the present invention.

DETAILED DESCRIPTION

Various embodiments of the present invention are described below in detail with reference to the accompanying drawings.

The drawings may not be to scale and, in some instances, proportions of the structures in the drawings may be exaggerated in order to clearly illustrate certain features of the described examples or implementations. In presenting a specific example in a drawing or description having two or more

layers in a multi-layer structure, the relative positioning relationship of such layers or the sequence of arranging the layers as shown reflects a particular implementation for the described or illustrated example and a different relative positioning relationship or sequence of arranging the layers may be possible. In addition, a described or illustrated example of a multi-layer structure may not reflect all layers present in that particular multilayer structure (e.g., one or more additional layers may be present between two illustrated layers). As a specific example, when a first layer in a described or illustrated multi-layer structure is referred to as being “on” or “over” a second layer or “on” or “over” a substrate, the first layer may be directly formed on the second layer or the substrate but this may also represent a structure where one or more other intermediate layers exist between the first layer and the second layer or the substrate.

The embodiments of the present invention provide a method for improving the integration degree and signal transmission characteristics of a fuse array including a plurality of programmable E-fuses. The embodiments of the present invention provide a fuse array in which a plurality of first fuse sets sharing a floating node and a plurality of second fuse sets sharing a contact node are arranged in a staggered fashion, and a strapping contact plug that is coupled to a conductive line extended between the first fuse sets and the second fuse sets.

First before embodiments of the present invention are described, a comparative example of a fuse array will be described with reference to FIG. 1.

FIG. 1 is a plan view of a comparative example fuse array.

As illustrated in FIG. 1, the comparative example fuse array includes a plurality of fuse sets **130** arranged in a 2D matrix and a strap region **150** for grouping the fuse sets **130**. Each of the fuse sets **130** includes a plurality of E-fuses **110** sharing a contact node **111**. For example, each of the fuse sets **130** may include two E-fuses **110** sharing a contact node **111**.

In the comparative example, the E-fuse **110** includes transistors. Specifically, the E-fuse **110** may include a program transistor for storing data and a select transistor for selecting any one of a plurality of E-fuses **110**. The program transistor and the select transistor share a junction region.

The program transistor includes a program gate **115**, and the program gate **115** is coupled to a program line PL to receive a voltage for programming the E-fuse **110**. The select transistor includes a select gate **117**, and the select gate **117** is coupled to a select line SL to receive a voltage for selecting any one of the plurality of E-fuses **110**.

The E-fuse **110** includes an active region **119**, a program gate **115**, and a select gate **117**. The active region **119** is defined by an isolation layer(not shown) formed in a substrate, and has one end serving as a contact node **111** and one end serving as a floating node **113**. The program gate **115** and the select gate **117** are formed over the substrate to overlap the active region **119**, are positioned between the contact node **111** and the floating node **113**, and are separated from each other. The program gate **115** is disposed adjacent to the floating node **113**. The select gate **117** is disposed adjacent to the contact node **111**. A gate dielectric layer (not illustrated) is formed between the program gate **115**, the select gate **117**, and the substrate, and whether the E-fuse **110** is programmed may be determined by whether the gate dielectric layer is broken-down(i.e., shorted).

In the comparative example, the fuse set **130** includes two E-fuses **110** sharing a contact node **111**. Thus, each fuse set **130** includes two select transistors sharing a contact node **111** and two program transistors each having a separate floating node **113**. A bit line(not shown) is coupled to the contact node

111 that is shared by the select transistors. The two program transistors include program gates **115** disposed adjacent to the respective floating nodes **113**. The two select transistors include select gates **117** disposed adjacent to the contact nodes **111**.

The fuse sets **130** are disposed in such a manner that the contact nodes **111** thereof connected with each other in a first direction D1, and a via contact plugs **133** that are formed over the contact nodes **111**. The contact plugs **133** serve to electrically couple the bit lines(not shown) and the fuse sets **130**. Surrounding on the contact plugs **133**, two E-fuses are arranged symmetrically with each other in a second direction D2.

In the comparative example, the plurality of fuse sets **130** are arranged so that they are separated in the first and second directions D1 and D2. In the first direction D1, the strap region **150** is disposed between groups of fuse sets **130**. The program lines PL and the select lines SL extend in the first direction D1 and couple the program gates **115** and the select gates **117** of the fuse sets **130**, respectively. Furthermore, the contact plugs **133** that are arranged in a line in the first direction D1 are coupled to a bit line (not illustrated).

In the fuse array, the strap region **150** groups together multiple fuse sets **130**. The strap region **150** includes dummy active regions **151** and a strapping contact plug **153** for strapping the program lines PL that are extended in the first direction D1. The strapping contact plug **153** is disposed between the dummy active regions **151**, and contacts the program line PL over the isolation layer. The strapping contact plug **153** serves to compensate for a voltage drop in the program line PL. Specifically, the fuse array includes a plurality of fuse sets **130**, and the program gates **115** formed in the respective fuse sets **130** are coupled to the program line PL extended in the first direction D1. When a voltage is applied to a program line PL of the fuse array, the voltage applied to the program line PL may drop because many program gates **115** are electrically coupled to one program line PL. That is, some of the program gates **115** may receive an abnormally low voltage because of a drop in voltage in the program line PL. The inability to deliver sufficient voltage may result in the program transistors being unable perform a normal program operation. Thus, the strap region **150** is required to compensate for the voltage drop of the program line PL. As described above, the strap region **150** includes a strapping contact plug **153** formed in the middle of the program line PL, which is extended in the first direction D1 and it applies a bias to the strapping contact plug **153** to compensate for a voltage drop occurring in the program line PL. In order to form the strap region **150** in the fuse array, the interval between the active regions **119** of the fuse sets **130** that are adjacent to the strap region **150** needs to be increased. Thus, in order to achieve a consistent pattern of active regions **119**, dummy active regions **151** need to be formed in the strap region **150**.

In the fuse array of the comparative example, a plurality of fuse sets **130** share contact nodes **111**. The plurality of fuse sets **130** sharing contact nodes **111** are extended in the first direction D1 and, a plurality of program gates **115** are coupled to one program line PL. The strap region **150** is required to compensate for the voltage drop of the program line PL when the program voltage for programming the fuse array is applied. However, since the strap region **150** is formed in the middle of the fuse array in which a plurality of fuse sets are uniformly arranged, the integration degree of the fuse array may be reduced. Furthermore, when the strap region **150** is formed, the interval between the active regions **119** that are adjacent to the strap region **150** needs to be increased, and the

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dummy active regions **151** are formed to secure process margin. Thus, the integration degree of the fuse array is further reduced.

The embodiments of the present invention provide a fuse array with an improved degree of integration. In the fuse array, a mixture of fuse sets sharing floating nodes and fuse sets sharing contact nodes may be used. Furthermore, fuse sets sharing floating nodes and fuse sets sharing contact nodes may be arranged in a staggered fashion. Thus, although no strap region is formed, it is possible to compensate for a voltage drop in conductive lines and increase the integration degree of the fuse array.

Hereafter, a fuse array in accordance with an embodiment of the present invention will be described in detail.

FIG. 2 is a plan view of an E-fuse in accordance with an embodiment of the present invention. FIG. 3A is a plan view of a fuse set including a plurality of E-fuses that share a floating nodes. FIG. 3B is a plan view of a fuse set including a plurality of E-fuses that share a contact nodes. FIG. 4 is a plan view of a fuse array in accordance with an embodiment of the present invention.

As illustrated in FIG. 2, an E-fuse **200** in accordance with an embodiment of the present invention may include transistors. Specifically, the E-fuse **200** may include a program transistor for programming and a select transistor for selecting a particular E-fuse. The program transistor and the select transistor may share a junction region.

The E-fuse **200** may include an active region **250** that is defined by an isolation layer formed in a substrate, and have one end serving as a floating node **210** and the other end serving as a contact node **230**. The E-fuse **200** may include first and second gates **270** and **290** formed over the substrate to overlap the active region **250**. The first and second gates **270** and **290** may be positioned between the floating node **210** and the contact node **230** and be separated from each other. The first gate **270** of the program transistor may be disposed adjacent to the floating node **210**. The second gate **290** of the select transistor may be disposed adjacent to the contact node **230**. The floating node **210** is a source region of the program transistor and may be floated. The contact node **230** is a source region of the select transistor and may be coupled to a bit line. As described above, a gate dielectric layer (not illustrated) may be formed between the substrate and the first and second gates **270** and **290**, and whether to program the E-fuse **200** is programmed may be determined by whether the gate dielectric layer, between the first gate **270** and the substrate, is broken-down.

In the embodiment of the present invention, two or more E-fuses **200** may form a fuse set and share floating node **210** or a contact node **230**. This configuration will be described in detail with reference to FIGS. 3A and 3B.

FIG. 3A is a plan view of a fuse set including plurality of E-fuses that share a floating node.

Referring to FIG. 3A, the fuse set **300** may include two E-fuses which share a floating node **210**. The fuse set **300** may include an active region **250** which is defined by an isolation layer(not shown), formed in a substrate that has both ends serving as contact nodes **230** and a center that serves as a floating node **210**. The fuse set **300** may include first and second gates **270** and **290** that are formed over the substrate and overlap the active region **250**. The first and second gates **270** and **290** may be positioned between the floating node **210** and the contact nodes **230** and be separated from each other. Specifically, the first gates **270** of the fuse set **300** may be positioned to face each other around the floating node **210**, and the contact nodes **230** may be positioned at both ends of the fuse set **300**. Furthermore, each of the second gates **290**

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may be disposed between the first gates **270** and the contact nodes **230**. Over each of the contact nodes **230** of the fuse set **300**, a contact plug **231** may be formed. The contact plug **231** may serve to electrically couple a conductive line and the fuse set. In the fuse set **300**, two E-fuses may be arranged symmetrically with each other, around the floating node **210**.

FIG. 3B is a plan view of a fuse set including a plurality of E-fuses in which a contact node is shared.

Referring to FIG. 3B, the fuse set **400** may include two E-fuses in which a contact node **230** is shared. The fuse set **400** may include an active region **250**, which is defined by an isolation layer(not shown) formed in a substrate, and two ends which serve as floating nodes **210** and a center which serves as a the contact node **230**. The fuse set **400** may include first and second gates **270** and **290** formed over the substrate that overlap with the active region **250**. The first and second gates **270** and **290** may be formed between the contact node **230** and the floating nodes **210** and be separated from each other. Specifically, the second gates **290** of the fuse set **400** may be positioned to face each other based around the contact node **230**, and the floating nodes **210** may be positioned at both ends of the fuse set **400**. Furthermore, each of the first gates **270** may be disposed between the second gate **290** and the floating node **210**. Over the contact node **230** shared by the two E-fuses, a contact plug **231** may be formed. The contact plug **231** may serve to electrically couple a conductive line and the fuse set **400**. In the fuse set **400**, two E-fuses may be arranged symmetrically with each other, based around the contact plug **231**.

Referring to FIG. 4, a fuse array in which a plurality of fuse sets **300** each sharing floating nodes and a plurality of fuse sets **400** each sharing contact nodes are arranged in an array will be described.

FIG. 4 is a plan view of a fuse array in accordance with an embodiment of the present invention.

As illustrated in FIG. 4, the fuse array in accordance with an embodiment of the present invention may include a plurality of first fuse sets **300** and a plurality of second fuse sets **400**. Each of the first fuse sets **300** may include a plurality of E-fuses **200** that share a floating node **210**. Each of the second fuse sets **400** may include a plurality of E-fuses **200** that share a contact node **230**. The fuse array may include a plurality of first conductive lines PL and a plurality of second conductive lines SL. The plurality of first conductive lines PL may be extended in the first direction D1 and be coupled to a plurality of first gates **270** positioned on the same line, and the plurality of second conductive lines SL may be extended in the first direction D1 and be coupled to a plurality of second gates **290** positioned on the same line. The fuse array may further include a plurality of third conductive lines BL that are extended in the first direction D1 and are coupled to a plurality of contact plugs **231** positioned on the same line. The fuse array may further include a plurality of strapping contact plugs **500** coupled to first conductive lines PL or second conductive lines SL that are extended between a plurality of first fuse sets **300** and a plurality of second fuse sets **400**.

Each of the first fuse sets **300** may have a floating node **210** formed in the center thereof and contact nodes **230** formed at both ends thereof in the second direction D2. The first fuse set **300** may include first gates **270** and second gates **290**. The first gates **270** may be disposed to face each other in the second direction D2 while sharing the floating node **210**, and each of the second gates **290** may be disposed between the first gates **270** and the contact nodes **230**. Over each of the contact nodes **230** of the first fuse set **300**, a contact plug **231** may be formed.

Each of the second fuse sets **400** may have a contact node **230** formed in the center thereof and floating nodes **210** formed at both ends thereof in the second direction **D2**. The second fuse set **400** may include second gates **290** and first gates **270**. The second gates **290** may be disposed to face each other in the second direction **D2** while sharing the contact node **230**, and each of the first gates **270** may be disposed between the second gates **290** and the floating node **210**. Over the contact node **230** of the second fuse set **400**, a contact plug **231** may be formed.

Furthermore, the fuse array may include a strapping contact plug **500** between each of the first fuse sets **300** and each of the second fuse sets **400**.

The fuse array in accordance with the embodiment of the present invention may include a plurality of first fuse sets and a plurality of second fuse sets **300** and **400** which are arranged in a staggered fashion in the first direction **D1**. The plurality of first fuse sets and the plurality of second fuse sets **300** and **400** may be arranged in a linear fashion in the second direction **D2**, which crosses the first direction **D1** (e.g. is substantially perpendicular to the first direction **D1**). Furthermore, the plurality of first and second fuse sets **300** and **400** may be alternately arranged in the first direction **D1** and the second direction **D2**. The strapping contact plug **500** may be disposed between the contact nodes **230** formed at the ends of each of the first fuse sets **300** and the floating nodes **210** formed at the ends of the each second fuse sets **400**.

The arrangement of the fuse array will be described with reference to regions A and B. In the region A, a first fuse set **300** is disposed to face a second fuse set **400** in the second direction **D2** and another first fuse set **300** in the first direction **D1**. However, the two first fuse sets **300** are facing each other in a staggered fashion in the first direction **D1**. In the region A, a second gate **290** disposed at one end of either first fuse set **300** may be electrically coupled to a second gate **290** disposed at the other end of another first fuse set **300**. Furthermore, first and second gates **270** and **290** at the other end of either of the first fuse sets **300** may be electrically coupled to first and second gates **270** and **290** at one end of a second fuse set **400**.

In the region B, one of the second fuse sets **400** is disposed to face a first fuse set **300** in the second direction **D2** and another second fuse set **400** in the first direction **D1**. However, the two second fuse sets **400** are facing each other in a staggered fashion in the first direction **D1**. In the region B, first and second gates **270** and **290** disposed at one end of a second fuse set **400** may be electrically coupled to first and second gates **270** and **290** disposed at the other end of one of the first fuse sets **300**. Furthermore, a first gate **270** at the other end of one of the second fuse sets **400** may be electrically coupled to a first gate **270** at one end of another second fuse set **400**.

In the fuse array in accordance with the embodiment of the present invention, the regions A and B may be extended and arranged in the first direction **D1**, and alternately disposed in the second direction **D2**.

Now the arrangement of the plurality of first and second conductive lines **PL** and **SL** will be described. In the fuse array, the plurality of first conductive lines **PL** and the plurality of second conductive lines **SL** may be spaced apart from each other in the second direction **D2**. Specifically, a pair of second conductive lines **SL** may be positioned at both sides of any one of the first conductive lines **PL** in the second direction **D2**, and a pair of first conductive lines **PL** may be positioned at both sides of any one of the second conductive lines **SL** in the second direction **D2**.

The third conductive line **BL** may be positioned at both sides of the second conductive lines **SL** in the second direction **D2** or positioned between the second conductive lines **SL**.

In the fuse array in accordance with the embodiment of the present invention, the plurality of first fuse sets **300** and the plurality of second fuse sets **400** may be arranged in a staggered fashion in a second direction **D2** and in a linear fashion in a first direction **D1** to form a plurality of spaces between the first fuse sets **300** and the second fuse sets **400**. This space may be formed over the isolation layer, instead of the active region **250**, because the first and second fuse sets **300** and **400** are formed in a staggered fashion. In the spaces, a plurality of strapping plugs **500** may be formed to strap the first and second conductive lines **PL** and **SL**. Thus, the plurality of strapping contact plugs **500** may be arranged in a staggered fashion in the first direction **D1** and the second direction **D2**. Each of the strapping contact plugs **500** may be coupled to a second conductive line **SL** adjacent to any one first conductive lines **PL**, which is, between a pair of second conductive lines **SL**. Furthermore, the strapping contact plug **500** may be coupled to a first conductive line **PL** adjacent to any one second conductive line **SL**, which is, between a pair of first conductive lines **PL**.

In the fuse array in accordance with the embodiment of the present invention, the first fuse sets **300** each sharing a floating node **210** and the second fuse sets **400** each sharing a contact node **230** are mixed. Thus, the integration degree of the fuse array may be increased. Furthermore, as the first fuse sets **300**, each sharing a floating node **210**, and the second fuse sets **400**, each sharing a contact node **230**, are disposed in a staggered fashion, a space may be formed between the first and second fuse sets **300** and **400**. In this space, the strapping contact plug **500** may be disposed. Thus, since no separate strap region needs to be formed between the active regions **250**, unlike the fuse array seen in the comparative example, the integration degree of the fuse array may be further increased.

In the fuse array in accordance with the comparative example, one strapping contact plug **500** per several tens of fuse sets is formed on one first conductive line **PL**. In the fuse array in accordance with the embodiment of the present invention, however, the strapping contact plug **500** may be formed between each of the first fuse sets **300** and each of the second fuse sets **400**. That is, since a larger number of strapping contact plugs **500** may be formed utilizing the inventive concept than in the fuse array seen in the comparative example, compensation for drops in voltage may be improved. Furthermore, as the strapping contact plugs **500** are coupled to the plurality of first and second conductive lines **PL** and **SL** coupled to the plurality of first and second fuse sets **300** and **400**, respectively, it is possible to compensate for voltage drops in both of the conductive lines. As a result, the resistance of the first and second conductive lines **PL** and **SL** arranged in the fuse array may be reduced to improve the overall signal transmission characteristics.

Although various embodiments have been described for illustrative purposes, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the invention as defined in the following claims.

What is claimed is:

1. A fuse array comprising:
an E-fuse including an active region, a floating node and a contact node;

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- a plurality of gates overlapping the active region and separated from each other between the floating node and the contact node; and
- a plurality of fuse sets each comprising two or more E-fuses that share the floating node or the contact node. 5
2. The fuse array of claim 1, wherein the plurality of fuse sets is arranged in a staggered fashion in one direction.
3. The fuse array of claim 1, wherein, in each E-fuse, the floating node is positioned at one end of the active region and the contact node is positioned at the other end of the active region. 10
4. The fuse array of claim 3, wherein the plurality of gates include a first gate and a second gate, and
in each E-fuse, the first gate is disposed adjacent to the floating node and over the active region, and the second gate is disposed adjacent to the contact node and over the active region. 15
5. The fuse array of claim 4, wherein the plurality of fuse sets comprise: 20
- a plurality of first fuse sets in which E-fuses share the floating node such that the first gates face each other and the contact nodes are positioned at opposite ends of each of the first fuse sets; and
 - a plurality of second fuse sets in which E-fuses share the contact node such that the second gates face each other and the floating nodes are positioned at opposite ends of the second fuse sets. 25
6. A fuse array comprising:
- a plurality of active regions each having two ends defined as a floating node and a contact node, respectively, and a plurality of E-fuses having first and second gates overlapping the respective active regions that are separated from each other between the floating node and the contact node, 30
- wherein the fuse array comprises a plurality of first fuse sets, each having two or more E-fuses that share the floating node, and a second plurality of second fuse sets, each having two or more E-fuses that share the contact node, and 40
- the plurality of first fuse sets and the plurality of second fuse sets are arranged in a staggered fashion in a first direction.
7. The fuse array of claim 6, further comprising:
- a plurality of first conductive lines extended in the first direction that are coupled to the plurality of first gates; 45
 - a plurality of second conductive lines extended in the first direction that are coupled to the plurality of second gates positioned on the same line; and
 - a plurality of strapping contact plugs coupled to the first conductive lines and the second conductive lines which are extended between the plurality of first fuse sets and the plurality of second fuse sets. 50
8. The fuse array of claim 7, wherein the plurality of first conductive lines and the plurality of second conductive lines are separated from each other in a second direction, which crosses the first direction, and 55
- the plurality of strapping contact plugs are positioned between the plurality of first fuse sets and the plurality of second fuse sets in the second direction.
9. The fuse array of claim 6 further comprising:
- a contact plug formed over each of the contact nodes; and
 - a plurality of third conductive lines extended in the first direction and coupled to the contact plugs. 60
10. The fuse array of claim 6, wherein the first and second fuse sets are alternately arranged in the first direction and a second direction that crosses the first direction. 65

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11. The fuse array of claim 6, wherein in a second direction that crosses the first direction,
- each of the first fuse sets shares the floating node such that the first gates face each other and the contact nodes are positioned at opposite ends of each of the first fuse sets, and
 - each of the second fuse sets shares the contact node such that the second gates face each other and the floating nodes are positioned at opposite ends of the fuse set.
12. The fuse array of claim 6, wherein any one of the first fuse sets faces the second fuse set and another first fuse set in the first direction, 10
- the second gate disposed at one end of the any one first fuse set is electrically coupled to the second gate at the other end of the another first fuse set, and
 - the first and second gates at the other end of the any one first fuse set are electrically coupled to the first and second gates at one end of the second fuse set.
13. The fuse array of claim 6, wherein any one of the second fuse sets face the first fuse set and another second fuse set in the first direction, 20
- the first and second gates disposed at one end of the any one second fuse set are electrically coupled to first and second gates at the other end of the first fuse set, and
 - the first gate at the other end of the any one second fuse set is electrically coupled to the first gate at one end of the another second fuse set.
14. A fuse array which includes a plurality of active regions each having two ends, defined as a floating node and a contact node, respectively, a plurality of E-fuses having first and second gates overlapping the respective active regions, wherein the first and second gates are separated from each other between the floating node and the contact node, a plurality of first fuse sets each having two or more E-fuses sharing the floating node, and a plurality of second fuse sets each having two or more E-fuses sharing the contact node, 30
- wherein the plurality of first fuse sets and the plurality of second fuse sets are arranged in a staggered fashion in a first direction, and 40
- the fuse array comprises:
- a plurality of first conductive lines extended in the first direction that are coupled to the plurality of first gates;
 - a plurality of second conductive lines extended in the first direction that are coupled to the plurality of second gates; and
 - a plurality of strapping contact plugs coupled to the first and second conductive lines, which are disposed between the plurality of first fuse sets and the plurality of second fuse sets in a second direction that crosses the first direction. 45
15. The fuse array of claim 14, further comprising:
- a contact plug formed over each of the contact nodes; and
 - a plurality of third conductive lines extended in the first direction that are coupled to the contact plugs.
16. The fuse array of claim 15, wherein the plurality of third conductive lines are positioned at both sides of the second conductive line or between the second conductive lines in the second direction. 50
17. The fuse array of claim 14, wherein the first and second fuse sets are alternately arranged in the first and second directions. 60
18. The fuse array of claim 14, wherein the strapping contact plugs are arranged in a staggered fashion in the first and second directions.
19. The fuse array of claim 14, wherein a pair of second conductive lines are positioned at both sides of any one of the first conductive lines in the second direction, and 65

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a pair of first conductive lines are positioned at both sides of any one of the second conductive lines in the second direction.

20. The fuse array of claim **19**, wherein a second conductive line adjacent to the any one first conductive line, which is, 5 between the pair of the second conductive lines, and a first conductive line adjacent to the any one second conductive line, which is, between the pair of first conductive lines, are coupled to the strapping contact plugs.

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